

Assessment of the magnitude of investment required in low carbon technologies for ships in meeting a 2°C decarbonisation pathway for shipping

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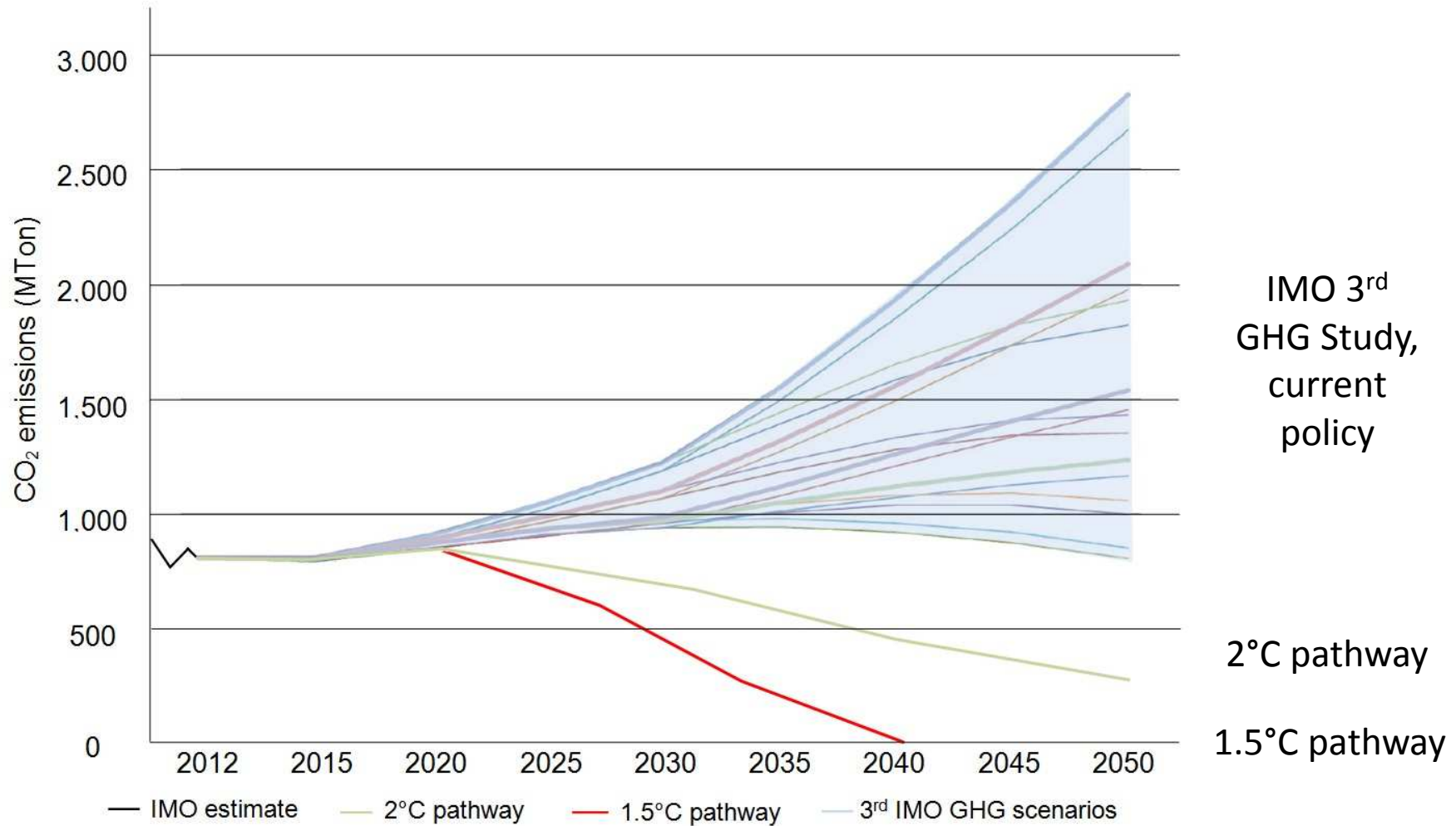
- Context & background
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CONTEXT



The scale of the challenge ahead

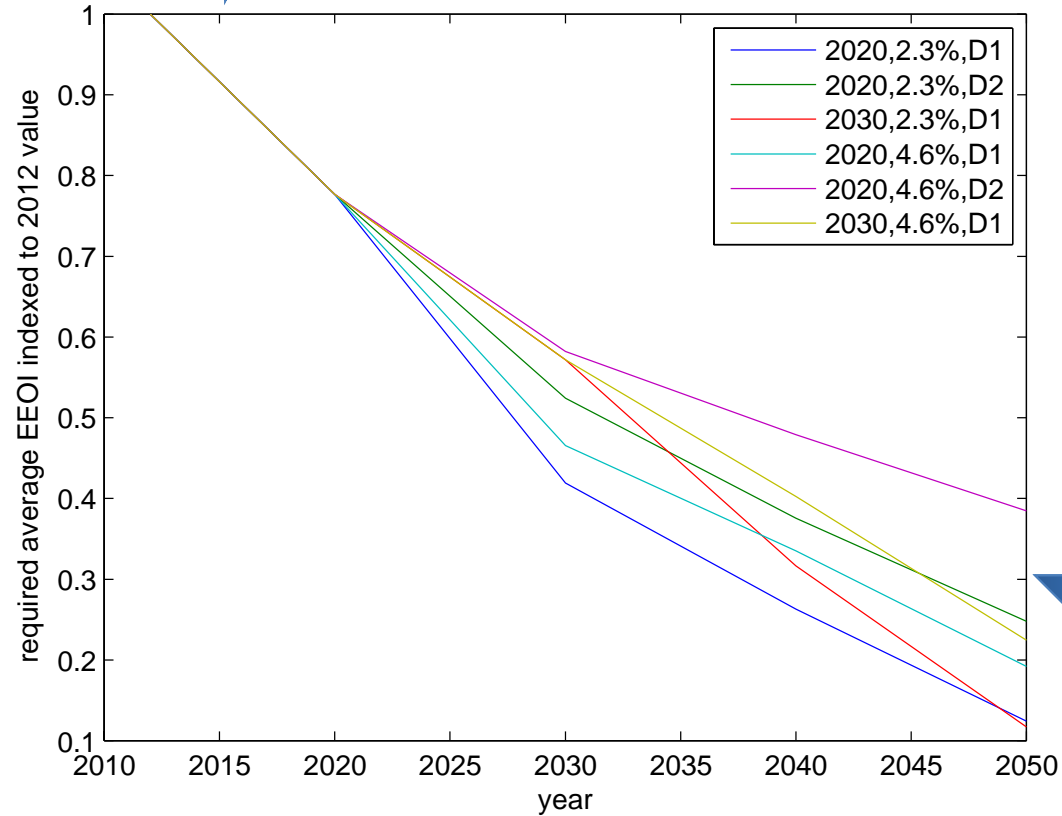


IF shipping continues to maintain a 2% share of global emissions, rising demand

Typical length of contract (charter)

Average economic lifespan of ships today

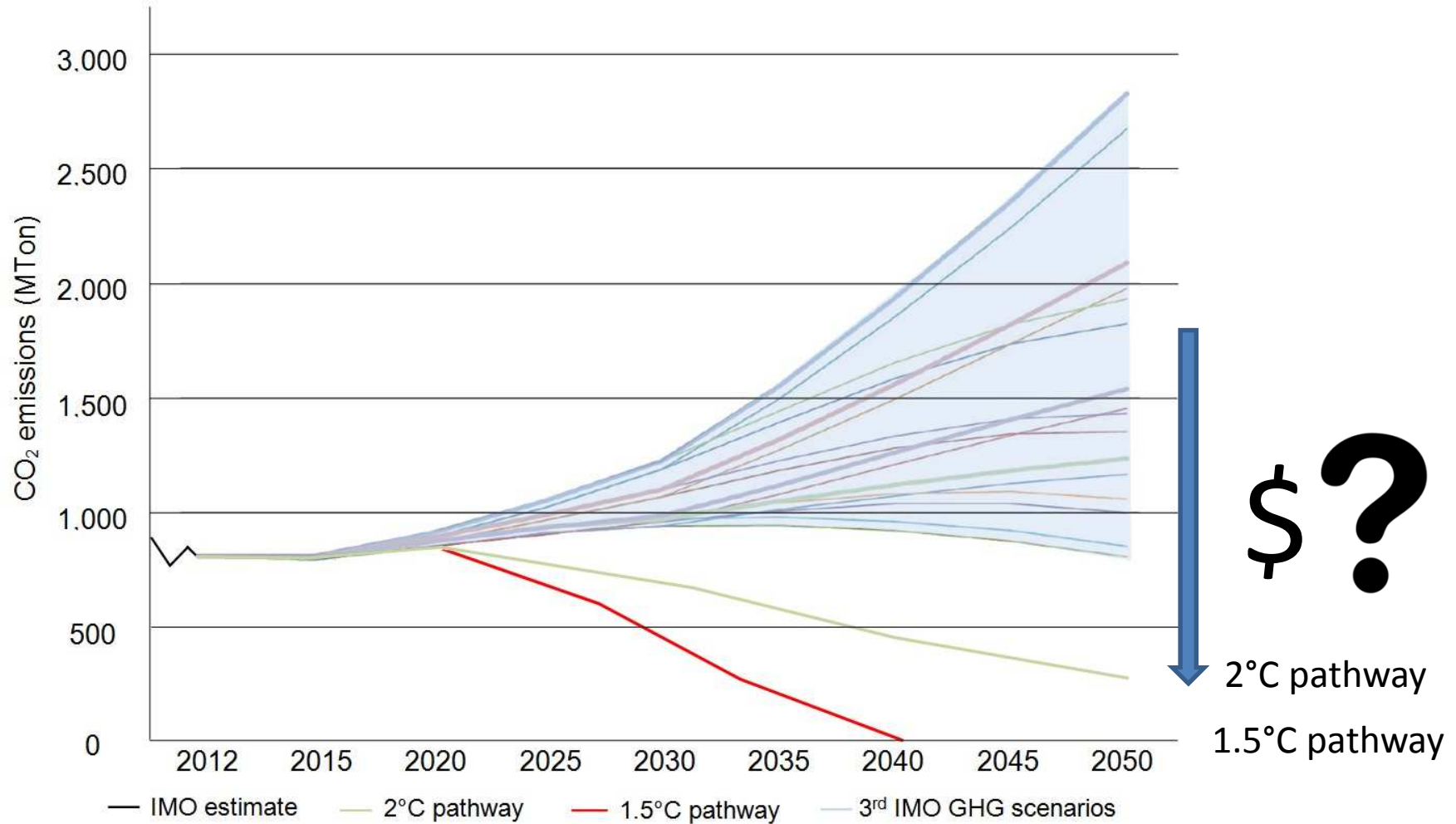
Max period for financing



60-90% decrease in fleet average carbon intensity



How much will it cost?



IF shipping continues to maintain a 2% share of global emissions, rising demand

Total costs

- Ships – retrofits and newbuilds
- Infrastructure – bunkering
- Offsetting



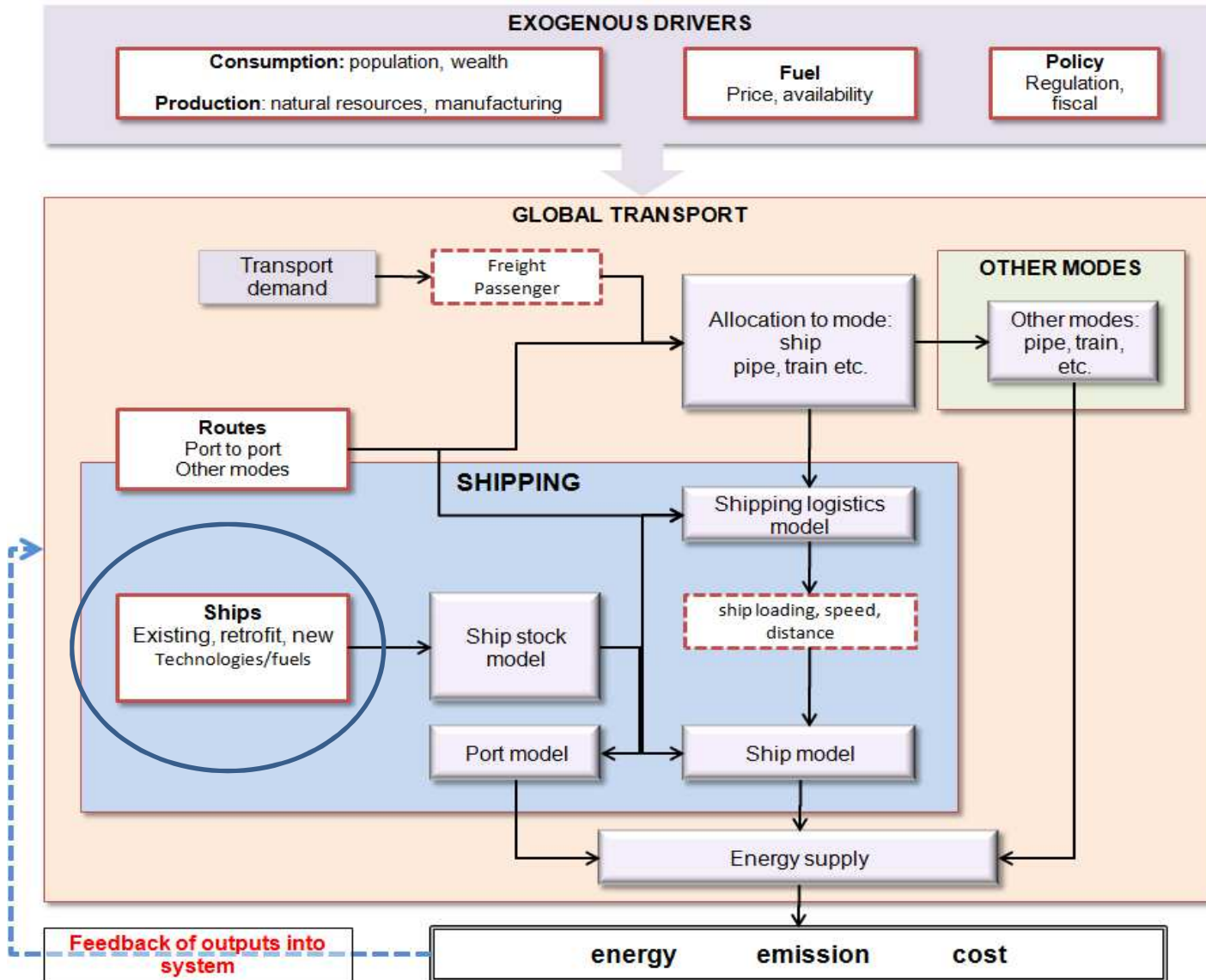
MODELLING APPROACH



Method 1

- Quick and easy?
- Whole fleet
- First pass of investment required in new ships





Model parameters/run specification

	Bioenergy availability	Trade dataset	btc	disc	IRR.value	NPV_year	npv_mm
Scenario1	High	GR	0.5	10	10	3	30
Scenario2	Central	MR2C	0.5	10	10	3	30
Scenario3	Low	HR	0.5	10	10	3	30
Scenario4	Low	MR4C	0.5	10	10	3	30



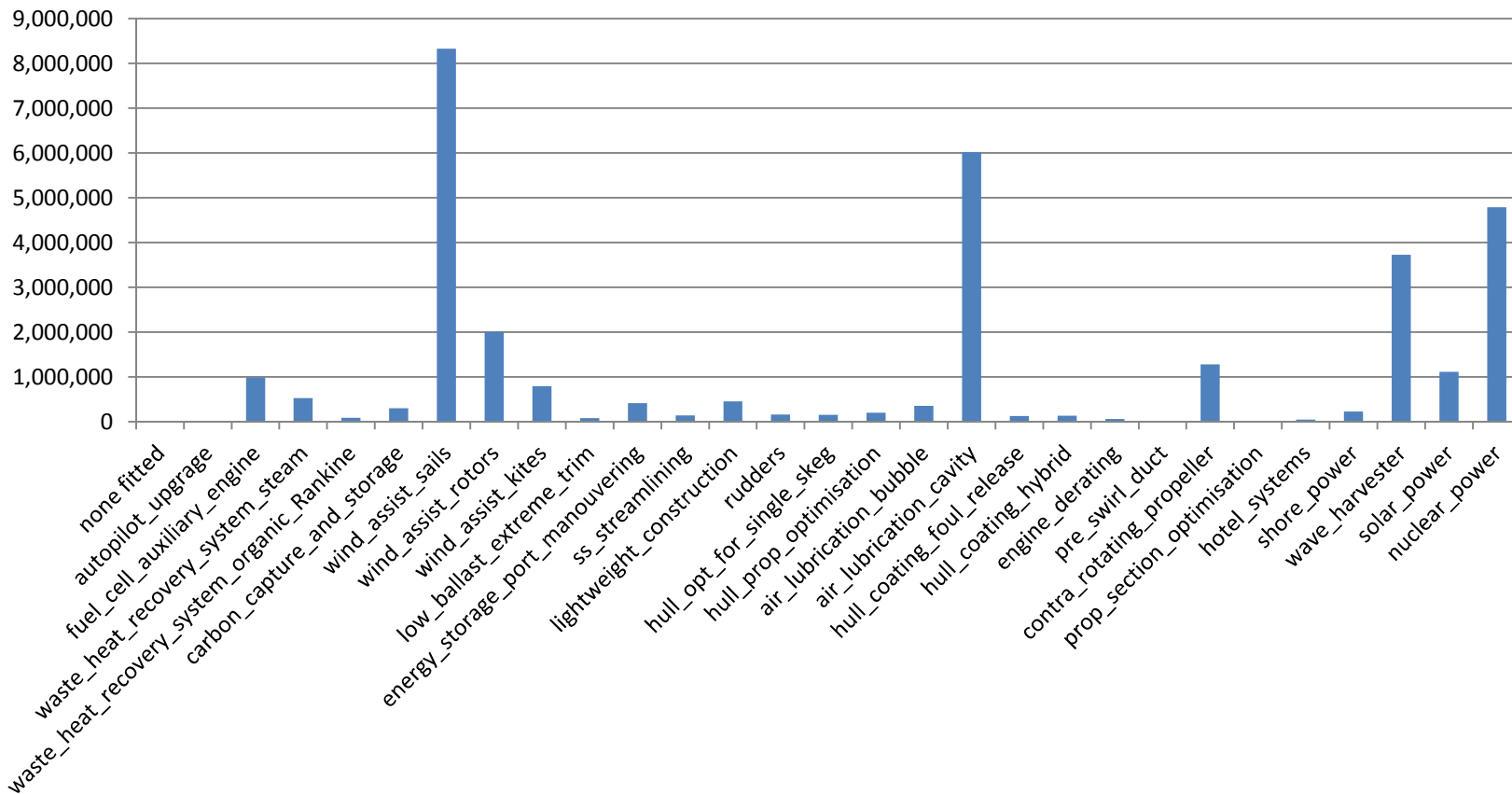
Technology takeup

Drybulk Size 2 - Newbuild	2015	2020	2025	2030	2035	2040	2045
autopilot_upgrade							
fuel_cell_auxiliary_engine							
waste_heat_recovery_system_steam							
waste_heat_recovery_system_organic_Rankine							
carbon_capture_and_storage							
wind_assist_sails							
wind_assist_rotors							
wind_assist_kites							
low_ballast_extreme_trim							
energy_storage_port_manouvering							
ss_streamlining							
lightweight_construction							
.....							



Technology costs

technology unit purchase cost (\$) - Drybulk size 2



Total cost

- Work in Progress

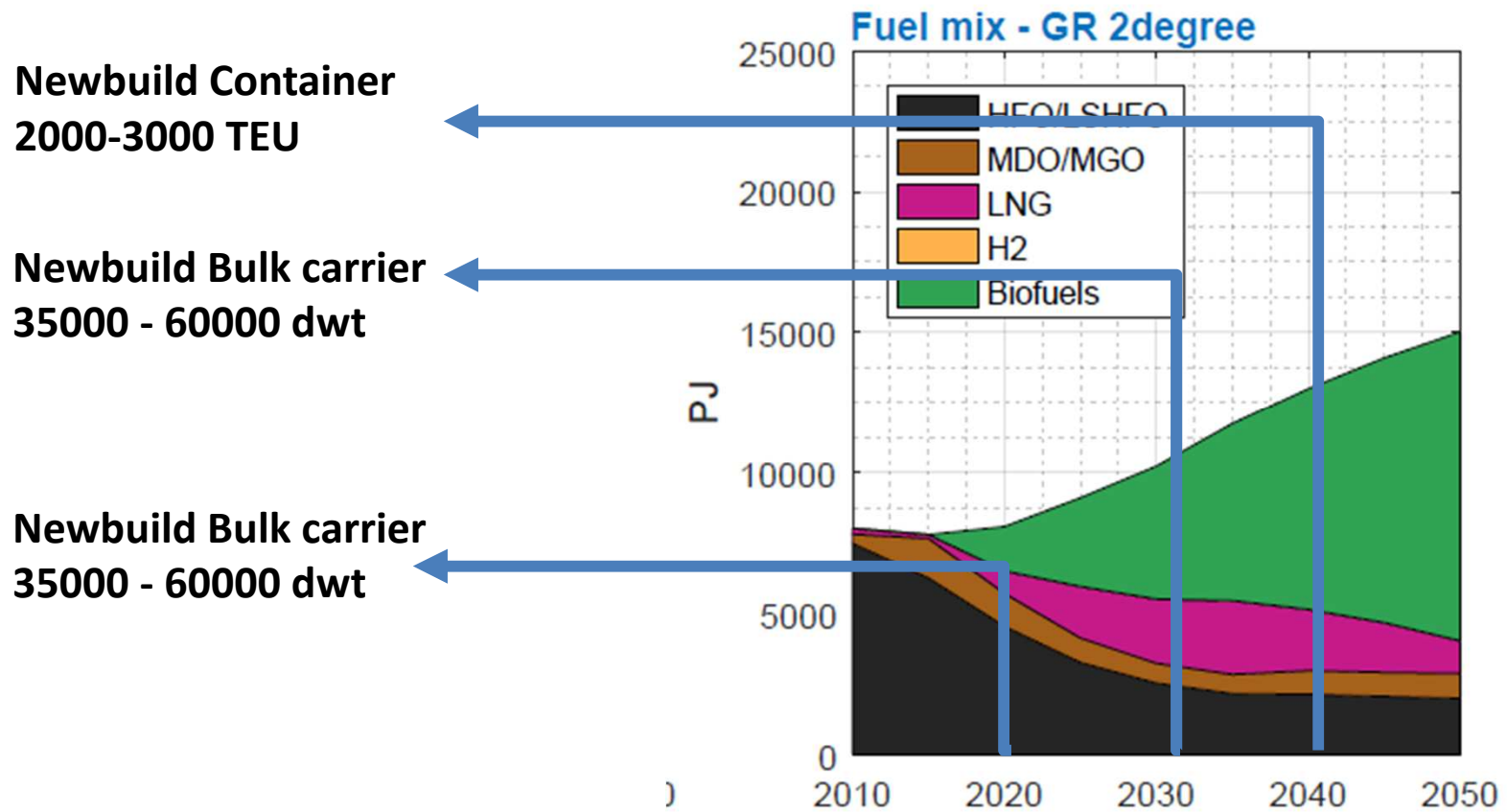


Method 2

- Per ship type
- Detailed breakdown of costs per year



Cases study



Technology selection (retrofit and newbuilds)

- Each time step
- Assessment of all combination of:
 - Engine and fuel
 - Energy efficiency technology packages
 - Operational speed
- The specifications with the highest NPV is selected

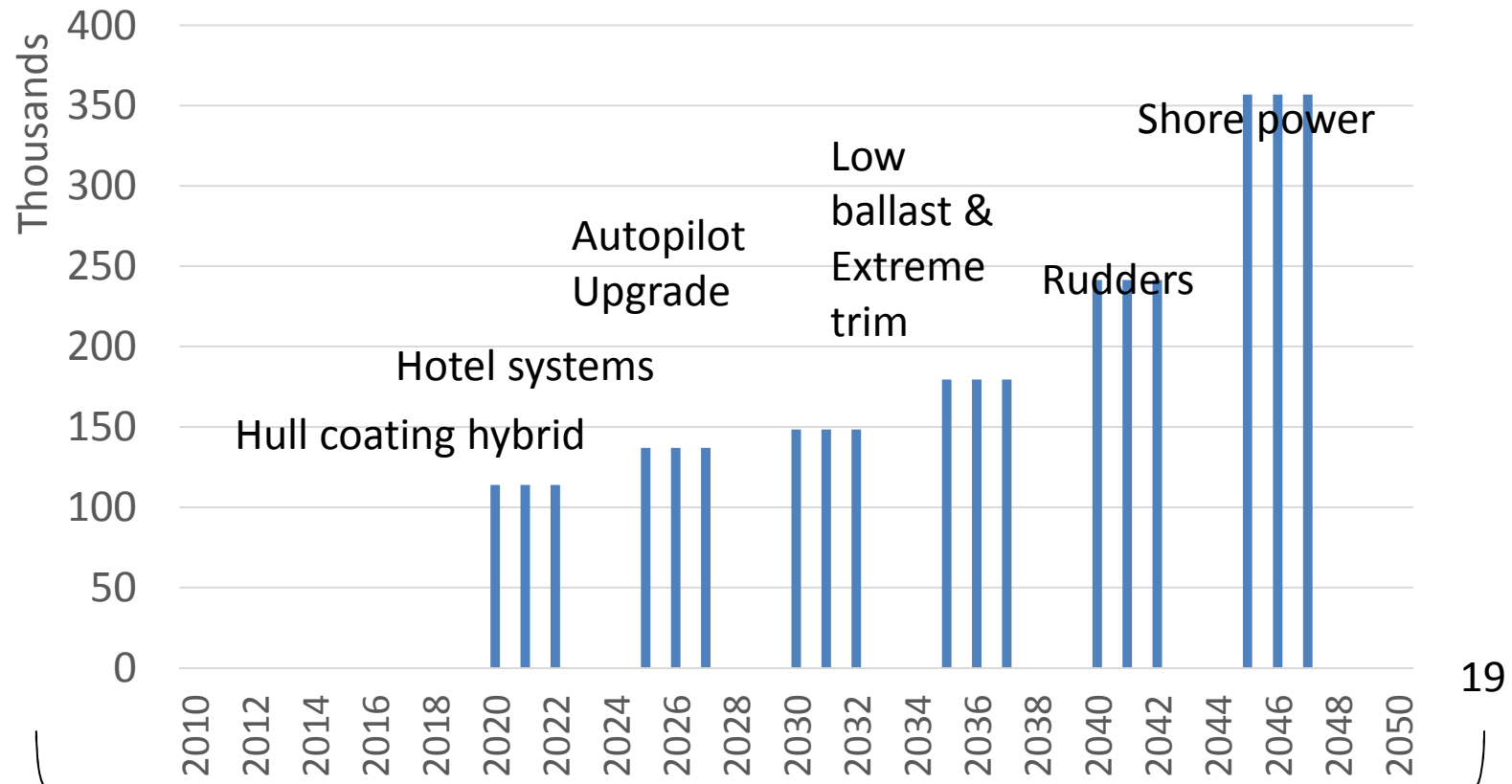


Time step	Bulk carrier 2020	Bulk carrier 2030	Container 2040
2020	<i>HFO+ICE</i> Hull coating hybrid		
2025	Hotel systems		
2030	Autopilot Upgrade	<i>LNG engine</i> Hull coating hybrid	
2035	Low ballast & Extreme trim	Hotel systems	
2040	Rudders	Low ballast & Extreme trim	<i>HFC engine</i> Hull coating hybrid
2045	Shore power	Rudders	Autopilot Upgrade
2050			Rudders



Additional investment required

Bulk carrier 35000-60000 dwt - newbuild 2020

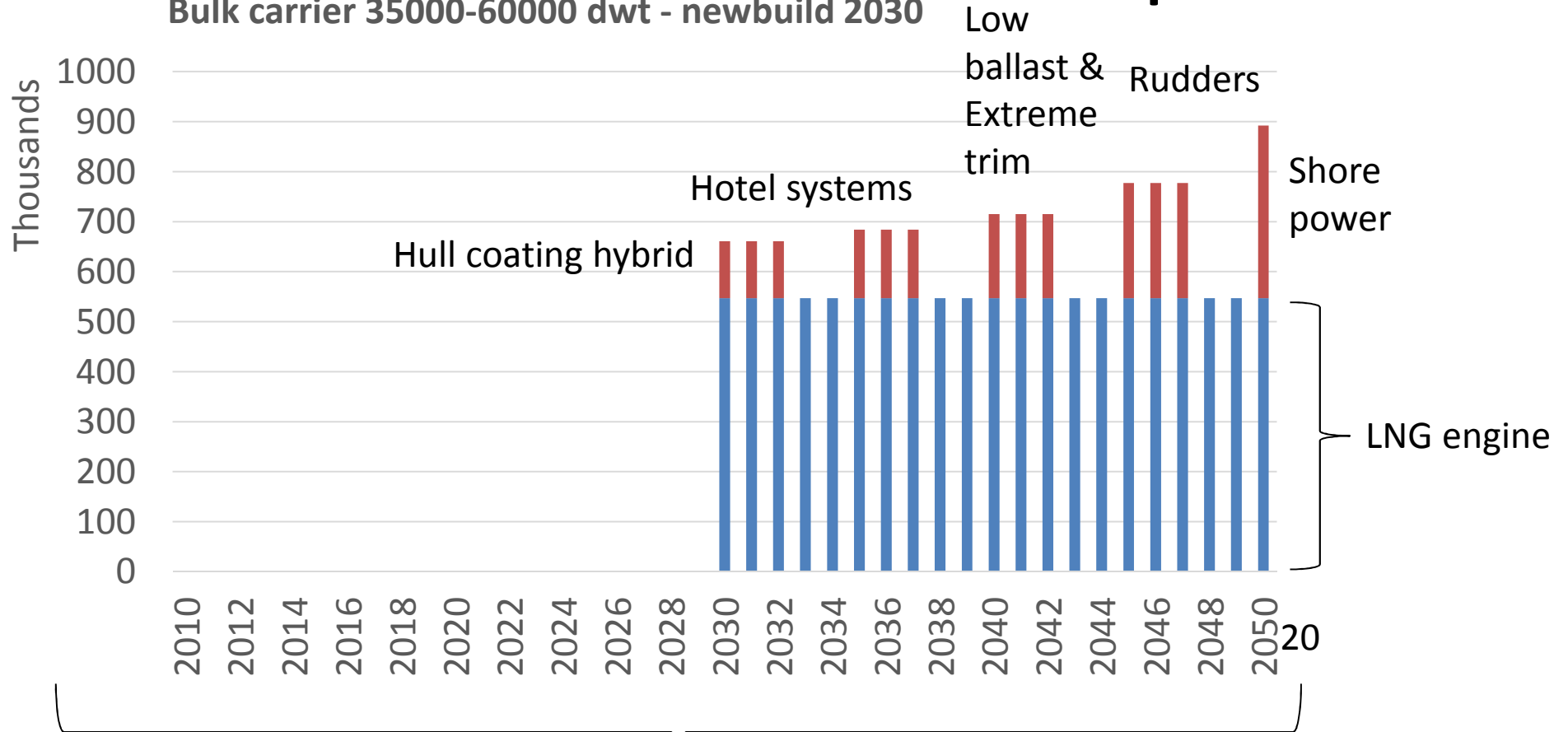


\$ 3,530,874



Additional investment required

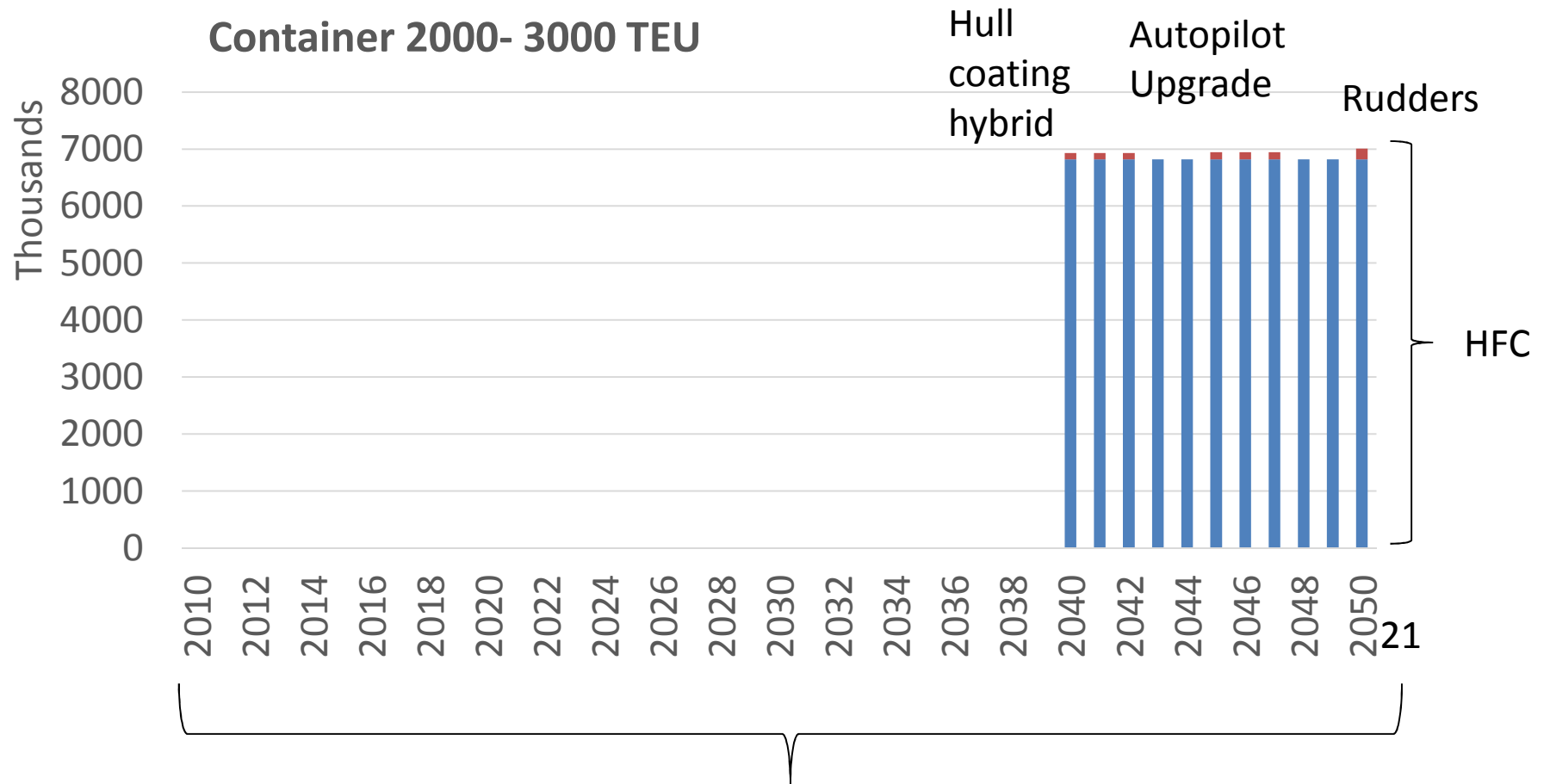
Bulk carrier 35000-60000 dwt - newbuild 2030



\$ 11,795,316



Additional investment required



\$ 55,260,255



Feedback

